DOCUMENT RESUME

ED 074 132 TM 002 495

AUTHOR Jaeger, Richard M.
TITLE An Evaluation of Sampling Designs for School Testing Programs.
PUB DATE Feb 73
NOTE 5p.; Paper presented at annual meetings of the Natl. Council on Measurement in Education and AERA (New Orleans, La., Feb. 25-March 1, 1973)

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Educational Accountability; *Program Evaluation; *Sampling; Speeches; *Testing Programs; *Test Results

ABSTRACT

While school systems most often use achievement test results for individual appraisals, increasing attention to program evaluation and accountability requires that test results be used for institutional appraisals as well. When institutional test results are desired--that is, results for schools or school districts--not all pupils need be tested. Two alternative testing program designs are proposed, for situations where individual test results are desired for some subject areas or grades, and institutional results are desired for others. Seventeen alternative finite-population sampling procedures can be used with these designs. The efficiency of each procedure is evaluated using data from a medium-sized school district, and relative efficiencies are derived. Some sampling procedures are found to yield acceptable precision for estimation of district-mean achievement with a sampling fraction of only five percent. (Author)

FILMED FROM BEST AVAILABLE COPY

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

ED 074132

Handout for

# AN EVALUATION OF SAMPLING DESIGNS FOR SCHOOL TESTING PROGRAMS

by

Richard M. Jaeger
Department of Applied Educational Sciences
University of South Florida

TM 002 495

Presented at annual meetings of the

National Council on Measurement in Education
American Educational Research Association

February, 1973

Table 1: Sampling procedures that can be used only with a complementary testing program where all pupils are tested in some subjects and sampled pupils are tested in other subjects (Plan I).

| |
|---|
| 1) Stratified sampling of pupils with proportional allocation of sample sizes to strata |
| 2) Stratified sampling of pupils with optimal allocation of sample sizes to strata |
| 3) Linear systematic sampling of pupils from a list arranged in increasing order of an auxiliary variable |
| 4) Linear systematic sampling of pupils from a list arranged in increasing order of an auxiliary variable, with use of end corrections in estimation |
| 5) Linear systematic sampling of pupils from a list arranged in increasing order of an auxiliary variable, then with order reversed in alternate strata |
| 6) Centrally located systematic sampling |
| 7) Balanced systematic sampling |
| 8) Simple random sampling of classrooms (single stage cluster sampling), with ratio estimation |
| 9) Single stage cluster sampling of classrooms where classrooms are selected with probabilities proportional to the values of a classroom-related auxiliary variable, and PPES estimation |

Table 2: Sampling procedures that can be used either with a complementary testing program where all pupils are tested in some subjects and some pupils are tested in others (Plan I), or with a plan where all pupils are tested in some grades and some pupils are tested in others (Plan II).

1) Simple random sampling of pupils

2) Linear systematic sampling of pupils from a list arranged in alphabetic order

3) Simple random sampling of schools (single stage cluster sampling), with unbiased estimation

4) Simple random sampling of schools (single state cluster sampling) with ratio estimation

5) Single stage cluster sampling of schools where schools are selected with probabilities proportional to their enrollments (PPS sampling) and PPS estimation

6) Single stage cluster sampling of schools where schools are selected with probabilities proportional to the values of a school-related auxiliary variable, and PPES estimation

7) Simple random sampling of classrooms (single stage cluster sampling), with unbiased estimation

8) Single stage cluster sampling of classrooms where classrooms are selected with probabilities proportional to their enrollmants (PPS sampling) and PPS estimation

Table 3: Sizes of Samples Required to Estimate Mean Reading Achievement within ± 0.2 Grade Equivalent Units with 95 Percent Confidence.*

| Sampling and Estimation Procedure | Required Sample Size |
|---|---|
| Simple Random Sampling (SRS) | 106 pupils |
| Stratified Sampling by Lorge-Thorndike Ability Test Scores - Six Strata: | |
| Proportional Allocation (Strat-prop) | 26 pupils |
| Optimal Allocation (Strat-opt) | 25 pupils |
| Linear Systematic Sampling: | |
| Alphabetic Order (LSS-alpha) | ≤ 59 pupils** |
| Increasing Order of Lorge-Thorndike Scores (LSS-inc) | ≤ 59 pupils** |
| Increasing Order of of Lorge-Thorndike Scores; End Corrections Used (LSS--E.C.) | ≤ 59 pupils** |
| Order Reversed in Alternate Strata (LSS-O.R) | ≤ 59 pupils** |
| Centrally Located Systematic Samples (CSS) | ≤ 59 pupils** |
| Balanced Systematic Sampling (BSS) | 118 pupils |
| Single Stage Cluster Sampling: | |
| Unbiased Estimation, Schools Used as Clusters (RSC-schools-unb) | 1041 pupils |
| Ratio Estimation, Schools Used as Clusters (RSC-schools-rat) | 394 pupils |
| Probabilities Proportional to School Enrollments, Schools Used as Clusters (PPS-schools) | 577 pupils |
| Probabilities Proportional to Fifth-Grade SCAT Score Totals, Schools Used as Clusters (PPES-schools) | 236 pupils |
| Unbiased Estimation, Classrooms Used as Clusters (RSC-class-unb) | 865 pupils |
| Ratio Estimation, Classrooms Used as Clusters (RSC-class-rat) | 262 pupils |
| Probabilities Proportional to Classroom Enrollments, Classrooms Used as Clusters (PPS-class) | 314 pupils |
| Probabilities Proportional to Lorge-Thorndike Score Totals, Classrooms Used as Clusters (PPES-class) | 53 pupils |

*Midcity data, population size = 1180 sixth-grade pupils.
**Five percent is the smallest sampling fraction investigated. Smaller sampling fractions might provide acceptable precision for these sampling methods.

Table 4: Sampling Fractions Required for Estimation of Proportion of Low-Achieving Pupils* for Various Sampling and Estimation Procedures.

| Sampling and Estimation Procedure | Required Sampling Fractions For Estimation within ± 0.02 at 95% Confidence | Required Sampling Fractions For Estimation within ± 0.05 at 95% Confidence |
|---|---|---|
| Simple Random Sampling (SRS) | 60% | 20% |
| Linear Systematic Sampling: | | |
| Population in Alphabetic Order (LSS-alpha) | 25% | 20% |
| Population in Increasing Order of Lorge-Thorndike Test Scores (LSS-inc) | 25% | 10% |
| Population in Increasing Order of Lorge-Thorndike Test Scores, End Corrections Used (LSS-E.C.) | 25% | 10% |
| Population in Increasing Order of Lorge-Thorndike Scores, Order Reversed in Alternate Strata (LSS-O.R.) | 25% | 10% |
| Balanced Systematic Sampling, Population in Increasing Order of Lorge-Thorndike Scores (BSS) | 25% | 10% |
| Centrally Located Systematic Samples, Population in Increasing Order of Lorge-Thorndike Test Scores (CSS) | 25% | 10% |

*Proportion of 1180 sixth-grade pupils in Midcity with reading achievement scores at least one grade equivalent unit below national norm.